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Aquaculture, Ahoy!

Why fish farming is becoming the fastest growing industry in agriculture

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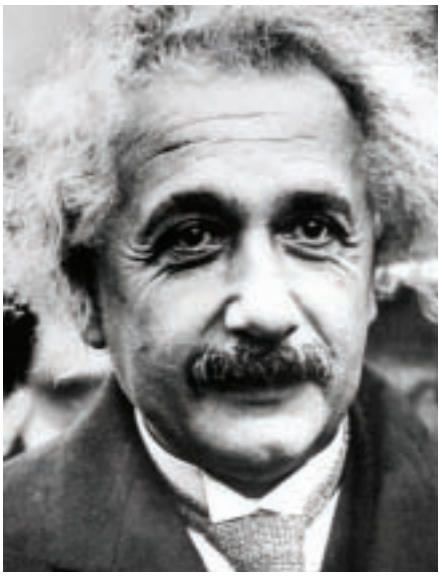

FEATURES

ON THE COVER Fish breeding pens at sea in Norway

DEPARTMENTS

BRIGHT IDEAS

The word "innovation" is stuck in my head as we gear up to open a new Innovation Center at Dixon. I'm convinced that as we ramp up our efforts in product development and speedier time-to-market, we must also find ways to encourage ideas from our distributors and users.

Some years ago, I heard a story about product development that went something like this: If you would have asked a farmer 100 years ago what he needed to be more productive, he might have replied a bigger horse that eats less. Yet, through innovation, we now have tractors that eliminated the need for the horse altogether.

Just as someone listened to the farmer's needs and worked on a horseless solution, today manufacturers must find ways to listen better. It is important to keep improving our products—but without user input, effective solutions will be slower to come. In this issue's cover story, "Aquaculture, Ahoy!" we bring you a story of innovation in action. As the world's supply of fish has dramatically shrunk, and demand for seafood has skyrocketed, longtime watermen have been forced to completely re-think their industry. The result of their efforts, as you'll discover, is a thriving new business model that is bringing profits, environmental sustainability—and good food!

Like the fish farmers, we all need to think about how we can create products that are better, safer and easier to use.

We welcome your ideas and suggestions at Dixon. Give us a try and let's see what will result.

Thanks for reading,

Dick Goodall

A RUN OF OLYMPIC PROPORTIONS

In preparation for the 2012 Summer Olympics in London, a relay of the Olympic torch—which will extend across the United Kingdom—will begin on May 19. One of the featured runners will be Dixon's Tony Lee, Bayco sales manager. Lee will carry the Olympic flame for a 300-meter (328-yard) leg of the journey, which will extend over 70 days and involve 8,000 runners.

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Conquering Fear

> The fear of bodily injury is not unusual. But there are other fears, though less intense, that are even more common. These fears imprison thousands of men and women in unhealthy, dysfunctional and even abusive personal and work-related relationships.

First is fear of change and uncertainty. Believing that "the devil you know is better than the devil you don't," people infected with this fear think bad relationships and jobs are better than nothing and their self-image is so low they can't imagine something better coming along.

Second is fear of disapproval. Some people dread embarrassment or rejection so much they are unwilling to do anything that risks the disapproval of others.

Third is fear of failure. Many people are so frightened by the possibility of failure they accept whatever they have as enough.

Last is fear of financial insecurity. Some people worry so much about how they will survive financially that they chain themselves to unhappy situations.

The common thread is an abiding but false feeling of inadequacy concerning the ability to handle challenges. There is no chemical antidote to fear and it's usually futile to lecture fearful people about replacing apprehension with self-assurance. We can't change timidity to boldness by edict or exhortation, but there is a strategy that can work. We can't simply manufacture courage and confidence, but we can force ourselves to act courageously even in the face of fear.

Don't wait to feel unafraid or certain. Think of yourself as an actor and act the way a brave person would. Fake it if you have to, but get moving! Each time you look fear in the face, you gain power over fear. And whether you believe it or not, you will survive—and in taking over your life, you will eventually thrive.

Healing Hands

Ben Carson overcame tough odds to become one of the world's top neurosurgeons

> He was, by his own admission, a horrible student.

It was just one of many hurdles blocking Benjamin Carson's path to success. Anger issues and low self-esteem also ranked. And, of course, there were other obstacles—growing up poor as the son of a single mother who had only a third-grade education and another son to provide for.

Carson's rise from poor and quick-tempered inner-city Detroit teenager to internationally renowned pediatric neurosurgeon has catapulted him into the spotlight—in a made-for-television movie on TNT, in books, in numerous television interviews—and garnered him countless awards, including the nation's highest civilian award, the 2008 Presidential Medal of Freedom.

Best known as the first physician to successfully separate conjoined twins connected at the back of the head, Carson has traveled the world performing separations that most believed impossible. Meanwhile, as his successes gained attention, his personal story began to resonate as well.

"IT'S MY BELIEF THAT GOD GIVES US ALL GIFTS ... AND THE GIFT OF EYE AND HAND COORDINATION HAS BEEN AN INVALUABLE ASSET IN SURGERY."

Often, in that narrative, it is the violent and unmanageable temper of his adolescence that plays one of the most defining roles. By his own account, he once tried to attack his mother with a hammer and, later, attempted to stab a friend during a fight over a radio station. The knife's blow was deflected by the young man's belt buckle, so no harm was done. But Carson walked away shaken.

Terrified of his own actions, Carson realized he had to gain better control of his temper and himself. Having long dreamed of becoming a physician, Carson decided to immerse himself in his studies. He graduated from high school with honors and then worked his way through Yale University, where he earned a degree in psychology. He continued on to medical school at the University of Michigan, where he made a fascinating self-discovery: While his temper once proved unsteady, his hands never did.

"I became acutely aware of an unusual ability—a divine gift, I believe—of extraordinary eye and hand coordination," Carson wrote in his autobiography, *Gifted Hands*. "It's my belief that God gives us all gifts … and the gift of eye and hand coordination has been an invaluable asset in surgery. This gift [encompasses] the ability to understand physical relationships, to think in three dimensions. Good surgeons must understand the consequences of each action, for they're often not able to see what's happening on the other side of the area in which they're actually working."

After medical school, Carson accepted a neurosurgery residency at Johns Hopkins Hospital. When his training

was finished, he began work as a neurosurgeon at Sir Charles Gairdner Hospital in Australia. A year later in 1984, he returned to Hopkins, where, at age 33, he was appointed director of pediatric neurosurgery. From there, his accomplishments continued mounting.

In 1987, Carson made history when he successfully separated 7-month-old twins Patrick and Benjamin Binder, who were joined at the head. The surgery, which took 22 hours and a team of 70 doctors, nurses and other support staff, was the first in a long series of separation procedures. In a career filled with operations that most surgeons would never dare attempt, not every case was as successful. "Every time a patient dies, I'll probably carry an emotional scar just as people receive an emotional wound when a family member dies," Carson has said. "As I look back on my own history of surgery and the work we do at Hopkins, I remind myself that thousands would have died if we hadn't operated."

Aside from his work with conjoined twins, Carson has broken medical ground in other ways. He was the first surgeon to perform an intrauterine procedure to relieve pressure on the brain of a hydrocephalic fetal twin. He is also known for his pioneering work in radical hemispherectomies—removing a portion of the brain to restore quality of life for patients with profound epilepsy.

In 2002, Carson was diagnosed with prostate cancer, and he cut back his workload significantly. Today he is cancer-free and still performs about 300 surgeries each year. He also has written several books, including *Think Big: Unleashing Your Potential for Excellence*, which offers advice for success.

Today, the neurosurgeon who got his start on the tough streets of Detroit actively works to inspire disadvantaged young people through the Carson Scholars Fund. The nonprofit, which he founded with Candy, his wife of more than 30 years, awards scholarships to children in grades 4 through 11 who exemplify academic excellence.

And, prompted by the way that reading transformed his own life, Carson and his wife also have established the Ben Carson Reading Project, which provides funding and support to schools to build and maintain Ben Carson Reading Rooms—warm, inviting spots "where kids can escape into the world of books."

"Knowledge is the key that unlocks all the doors," Carson writes in *Think Big*. "You can be green-skinned with yellow polka dots and come from Mars, but if you have knowledge that people need, instead of beating you, they'll beat a path to your door."

Aquaculture, Ahoy!

Watermen harvest salmon at Fish Farm Nelson in South Island, New Zealand. Right: A thriving fish farm in the azure waters of the Greek Islands.

Fish farming is becoming the fastest growing industry in agriculture

BY RONA KOBELL

DAVE HARP

FOR DECADES, JOHNNY Shockley fought the winds and the tides on the Chesapeake Bay, dredging along its silted bottom to bring up the plumpest, rounded oysters he could find. He did it for the same reason his father did it, and his grandfather before him: Oystering made for a good living in the small watermen's village where the Shockley men were born and raised.

But in 2009, Shockley found that the tide had turned—not just on his beloved Hooper's Island, but on the entire Maryland coast. Oyster populations had reached less than 1 percent of their historic levels. Because oysters are important filter feeders that help reduce pollution, the state was moving to close nearly a quarter of the public oyster grounds in

Top: Working the floats at a Choptank River oyster farm in Cambridge, Md. Above: Johnny Shockley shows off his crop of "Chesapeake Gold" oysters on Hooper's Island. Many aquafarmers "tumble" their oysters to give them a rounder, smoother shell.

Aquaculture in the World

The seafood we get at the local place down the road is often anything but local. The crabmeat at a seaside shack in North Carolina may be from Thailand; the salmon at an upscale Oregon bistro may have been raised in a Chilean pond. Increasingly, customers want to know where their fish is coming from, and upscale grocery labels sometimes tell them when it's caught in the wild. But often, the answer is a pond, somewhere far away. Here's a look at aquaculture around the world.

Asia
The Chinese were reportedly the first to raise fish in ponds 5,000 years ago, and they are the world leaders in aquaculture. China accounts for two-thirds of the world's fish production. Its main export is the common carp. In 2005, the value of China's aquaculture was close to $40 billion, about half of the worldwide value of aquaculture. In Asia, India is the second-ranked producer of seafood.

Canada
Canada's waters support fresh salmon and its Great Lakes are home to a variety of trout. But in aquaculture, salmon are down and mussels are up. In 2009, salmon sales dropped about 9 percent, while mussel sales increased by about that amount. Operating revenues for the country jumped 20.8 percent, to $908.2 million. Canada continues to grow large numbers of Great Lakes species to stock for the thriving sport-fishing industry on both sides of the border.

Central and South America
Aquaculture is thriving in the Southern Hemisphere. Top producers include Brazil, Chile, Peru, Mexico and Argentina. Chile is the largest producer of farmed salmon, after Norway. Increasingly, Peru is a major producer of fishmeal—ground-up wild fish that farmers feed to the farm-raised crops. Argentina's main export is rainbow trout, with oysters and mussels gaining ground as top crops. Brazil and Mexico are known for their tilapia production. All these countries have a competitive advantage with their warm climates.

Europe
Norway has been raising fish for nearly half a century. In 2003, its production of salmon was valued at $350 million. Salmon accounted for 80 percent of Norwegian fish farming, followed by rainbow trout, halibut and cod. Norwegians also raise mussels and oysters. More than 90 percent of the fish farms throughout Europe are small, family-style operations. Norway accounts for 23 percent of Europe's aquaculture operations, followed by France at 17 percent. The French are known for their cultivation of oysters, and farmers from all over the world travel to the French coast to learn from those operations.

Source: Food and Agriculture Organization of the United Nations

hopes of bringing the population back.

In the midst of the cuts, Maryland officials threw watermen a lifeline. They relaxed century-old rules prohibiting oyster and clam aquaculture. Though Maryland watermen had resisted the practice of raising shellfish since the late 1800s, watermen in Virginia had long been successful at it. And, with a new cultured oyster that could grow more than twice as fast as a wild one, they were getting even better.

Shockley drove south to take a look. Within a year, his aquaculture business, the Hooper's Island Oyster Co., had set up at the end of a winding island road near the offices of his partner, seafood buyer Ricky Fitzhugh. On Tar Bay's bottom, Shockley is growing millions of oysters in cages. He's calling them Chesapeake Gold.

"It's a change from what we're used to," Shockley says of aquaculture. "But when people see how this plays out, it's going to make sense."

To scientists, it already does. Dr. Mark Luckenbach, a Virginia Institute of Marine Science oyster biologist, likes to say that, for most places, aquaculture isn't the future: It's the present.

"To the best of my knowledge," he says, "there are no wild oyster fisheries in the world that aren't going in the same direction as ours."

That's true for most aquaculture. In Asia, shrimp and fish farming is a global business. China and Thailand produce most of the world's shrimp in tanks and ponds throughout the countryside. The French have grown oysters in cages and bags for close to a century, while the states along the Mississippi River in the United States have long raised catfish in ponds. Governments have gotten into aquaculture, too: Canadian authorities spend several million dollars each year to raise and culture fish, which they then deposit in the Great Lakes and rivers to support the recreational trout and salmon fishery.

In some cases, aquaculture can provide a product that consumers love but can no longer find in abundance. In other cases, consumers are looking for healthy options but want to know that the fish or shellfish is grown sustainably.

"We're running out of fish," says Dr. Yonathan Zohar, chair of the Department of Marine Biotechnology at the University of Maryland,

Aquaculture has brought fish that had been scarce back to the menu, notes Yonathan Zohar, who is seen here with Mediterranean sea bream.

Baltimore County (UMBC). "Fish are the last hunt-and-gather live crop. You don't go into the wild to harvest your chickens, your bovines, but you do with fish. And as a result of that, aquaculture has become the fastest growing agriculture industry in the United States."

Zohar, a marine endocrinologist who was born in Israel and educated in Paris, grows fish in a basement lab at Baltimore's Inner Harbor. He started with sea bream, graduating to bronzini and cobia. A veteran of many international conferences on the topic, Zohar says that small-scale and sustainable aquaculture not only provides employment opportunities—it also brings species on the verge of disappearing back to the menu.

Sea bass is an example of a well-loved fish that became scarce. Chilean Sea Bass, which was originally called the Patagonian toothfish, used to grace the plates of the finest restaurants. Then it became very difficult to stock, after conservationists warned that the fish was in danger of extinction.

That led enterprising farmers to raise different varieties of sea bass in ponds thousands of miles from Chile—from Australia to India to Poland. In the Philippines, Finfish Hatcheries Inc. is the country's largest commercial fry hatchery, and the only source of sea bass fingerlings, according to *Agriculture Business Week*.

It takes a sea bass about one year to grow from fingerling to table size (400 to 600 grams or 0.9 pound to 1.3 pounds). During their first month, the fingerlings grow from 1 inch to 4 inches in a nursery setting, eating ground fish or fry mash. Then fish farmers move them to a sea pond known as a "transition pond," where they spend two or three months as juveniles. Finally, they enter marine cages, where they subsist on baitfish and continue to grow until reaching maturity.

Finfish Hatcheries notes that farming sea bass is relatively easy—and profitable. "This type of fish rarely schools or moves," says a FHI spokesman, "and they can grow in a very wide range of salinity." Stocking a pond with 1,000 sea bass fingerlings will produce about 5,000 kilograms (roughly 11,000 pounds) of matured sea bass, according to a study by the Brackishwater Aquaculture Center of the University of the Philippines.

Of course, there are some drawbacks to growing fish. Aquaculture can introduce unwanted invaders that become expensive problems for ecosystems. For example, catfish farmers on the Mississippi River brought in Asian carp to eat the algae fouling the ponds. The carp escaped after a flood in the 1990s and got into the Mississippi where, absent any natural predators, they ate their way through the food chain. Now, scientists believe that the carp have invaded the Great Lakes, though no one is certain of the numbers or the damage they could do.

"That is probably the biggest issue, [introducing] an invasive species when

you're bringing in a new species to grow. A flood comes along, and that spreads the fish all out," says Dr. Jim Diana, director of the Michigan Sea Grant program and a longtime professor of fisheries and aquaculture at the University of Michigan in Ann Arbor. "So the technique is not to culture things outside of their native areas, or individuals that are not viable."

Profits on the Half Shell

Shellfish aquaculture is the fastest growing segment of the United States' aquafarming industry, according to the National Oceanic and Atmospheric Administration. And within shellfish, oysters are a major growth area.

The sterile oyster has become a game-changer in Virginia, where oyster geneticist Dr. Standish Allen began producing them in large quantities six years ago as part of a government-financed experiment. Only bred in labs and hatcheries, sterile oysters have three chromosomes instead of two. Since they put all their energy into growth and none into reproduction, they reach market size in 12 to 18 months instead of the three years it takes an oyster in the wild.

That quicker growth rate is key. Disease began to hit Chesapeake Bay oysters in the 1950s; by the 1990s, populations were devastated. The three-chromosome oyster is not immune to the parasites—known as MSX and Dermo—that attacked the native oysters. But it can outrun them; disease usually hits in the second or third year, and the sterile oysters have already reached market size by then.

Once entrepreneurs showed what they could do, more farmers jumped in. In 2005, Virginia oyster culturists planted 6.2 million oysters. By 2009, that number increased nearly fivefold, to 28.3 million, according to the Virginia Shellfish Aquaculture Crop Reporting Survey.

In 2005, Virginia oyster culturists planted 6.2 million oysters. By 2009, that number increased nearly fivefold, to 28.3 million.

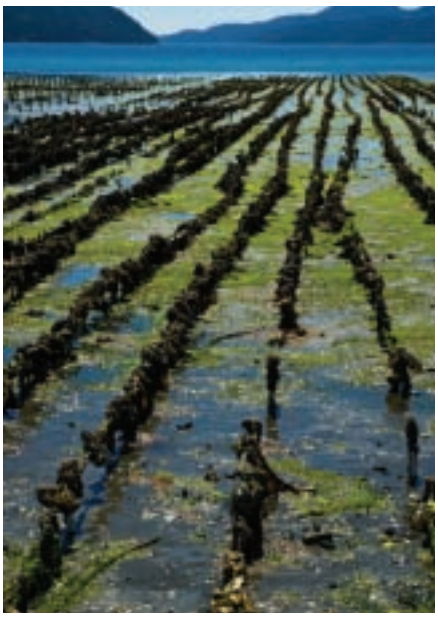
Farmers grow oysters in two ways. The oldest method is spat-on-shell. In a tank, when the temperature is ready for spawning, oysters shoot sperm and eggs at each other. Once the gametes fertilize, they become oyster larvae and swim freely for one to two weeks. Then they search for a place to spend the rest of their lives. They'll find it in a shell that is placed in the tank, usually within a plastic mesh bag. Then the farmer takes the shell bags out to a leased bed, opens the bags, and plants them on the bottom of the bay. In about two years, the oysters will reach market size.

Spat-on-shell is cheap, because equipment costs are low and nature does most of the work. But it has limitations. Growers can't control conditions. And because the oysters grow clumped together, they don't look as pretty on a plate. They are ideal for the shucking houses, but they need to be managed consistently if they are going to restaurants.

Consequently, some oyster growers have turned to cultchless oysters. In this method, the hatchery seed settles not on a large shell but in a tiny sliver known as microcultch. These oysters must be nurtured in a nursery system until they are large enough to plant. These nurseries, called upwellers, pipe in seawater to feed the oysters. Different sized screens let the water enter and prevent the oysters from leaving.

When they're large enough, cultchless oysters can be grown in floats on top of the water, in cages or in bags on top of racks—a technique known as rack-and-bag that's common in New England and France.

In all of these methods, the farmers have a lot of quality control. They can take out the oysters, wash them, tumble them and move them around. That control can be expensive, as upwellers can run as high as $9,000 and sorting and tumbling systems can be twice that. But the advantage is a higher price at market. These are the oysters gracing



Left: Hundreds of trout swim in two pools at a trout farm in Abruzzo, Italy. Right: An oyster farm at low tide on Orcas Island in Washington state.

Left: Cage culture, in which oysters are grown in mesh bags, is becoming increasingly popular. Right: Oyster farmer Perry Raso shucks oysters at his restaurant, Matunuck Oyster Bar, in Rhode Island. His oyster grounds are available for tours.

the tables of high-end restaurants at $12 for a plate of six.

Floats have one major disadvantage: Wealthy waterfront neighbors would rather not look at them. In the case of the Choptank Oyster Co. in Cambridge, Md., managers had to move their floats after neighbors complained.

In Virginia, and increasingly in Maryland, cage culture is becoming more popular. In this method, the oysters are grown in mesh bags—one on each side of a cage placed several inches off the Bay bottom. Passers-by cannot see the cages. Oystermen put their crops in ever larger bags as they grow, washing the product and running them through a tumbler to make sure they are round and smooth.

Unlikely Farmers

Aquafarmers come from all walks of life. They are bankers, engineers, scientists and teachers. Increasingly, though, they are commercial watermen and fishermen like Shockley, which doesn't surprise anyone who's worked on the water. Tommy Leggett, an oyster grower in Virginia, used to ply the Bay in a small boat dredging for clams and oysters. He earned a master's degree in fisheries science and, in 1996, started his own aquaculture business. He also runs the Chesapeake Bay Foundation's oyster demonstration farm near Hampton Roads, Va.

Watermen and fishermen, Leggett says, are riggers. "They know how to figure things out."

Aquafarmers come from all walks of life. They are bankers, engineers, scientists and teachers. Increasingly, though, they are commercial watermen.

In Rhode Island, clam farmer Perry Raso saw the potential for oyster aquaculture when he was just 23 years old. He started with one acre in 2002; now, his Matunuck Oyster Farm includes a popular restaurant, Matunuck Oyster Bar.

Raso invested $90,000 during the first three years in his business; during that time, he says, he didn't make much money. Perhaps that's why aquaculturists joke that the way to make a small fortune in the business is to start with a large one.

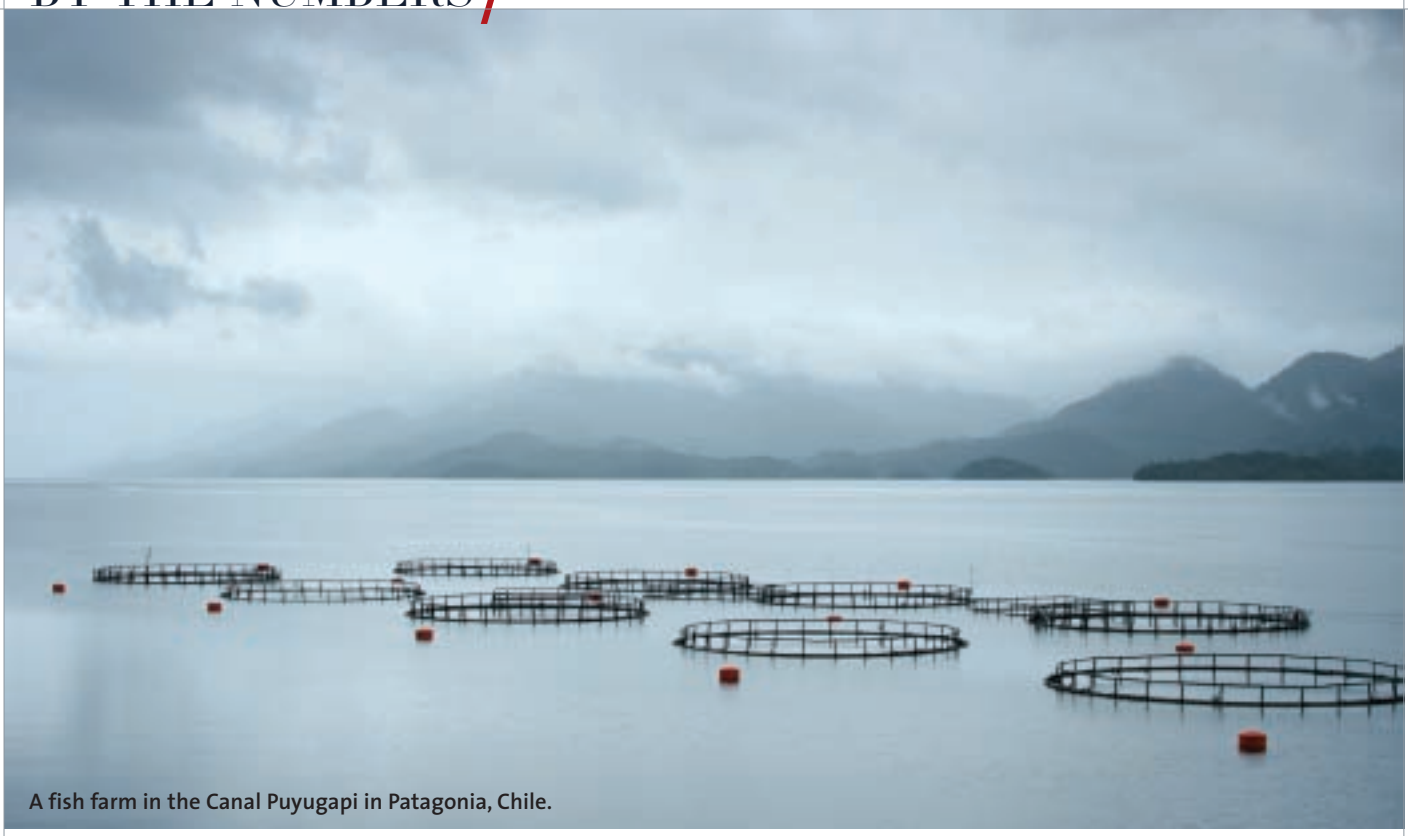
"You can't just quit your job and say you're going to start an aquafarm, because you're not going to get paid for two years," Raso warns.

But eventually, he says, you will get paid, and not just with cash. Matunuck earns raves for its consistently fresh seafood, and environmentalists have praised Raso's oyster grounds, which are available for tours.

Raso raises about half a million oysters a year for the restaurant market. In Washington state, Taylor Shellfish Farms, the largest oyster company on the West Coast, produces about 100 million oysters a year.

Shockley would like to be one of the big guys, selling not just oysters but also nurseries, cages and the other equipment he's taught himself how to construct. Once other watermen see that they can succeed, Shockley believes he'll have a ripe equipment market. And he's not worried about competition; there is a big enough market for everyone to have a bite.

"This is where we have a leg up," Shockley says of the watermen. "This is why we're going to be great at it. We can do all these things. To us, this is easy."



A fish farm in the Canal Puyugapi in Patagonia, Chile.

Aquaculture

is the art of growing fish and shellfish in closed marine systems. Though close to 5,000 years old, this ancient Asian practice only came to the United States about 100 years ago. It has been growing steadily since the 1960s. The National Oceanic and Atmospheric Administration recently announced a new policy to encourage aquaculture across the nation, in part to help the U.S. catch up with places like China and Latin America, where the practice has thrived for decades. Here's a look at aquaculture by the numbers:

- Aquaculture is one of the fastest-growing industries worldwide, growing at about 6.5 percent each year.
- China produces 61 percent of the world's aquaculture products.
- More than 50 percent of the fish consumed worldwide is grown in ponds and tanks.
- The value of U.S. aquaculture production is more than $1.3 billion a year. U.S. aquaculturists produce more than 500,000 metric tons of plants and animals each year.
- Some 84 percent of the seafood Americans consume is imported, according to the NOAA.
- The No. 1 fish species grown in the United States? Catfish, largely raised in the South. Tilapia and rainbow trout are a distant second and third.
- Shellfish is one of the fastest growing aquaculture segments in the United States, according to NOAA. Nearly 80 percent of marine aquaculture in the U.S. is shellfish: oysters, crayfish, clams or shrimp.

Source: NOAA; Fish Technology Associates

A young boy walks on a bronze sculpture of Albert Einstein, outside the National Academy of Sciences building in Washington, D.C.
Bottom right: A special postage stamp, issued in Berlin, Germany, on June 15, 2005, commemorates "100 years of relativity, atoms, quants."

ORIGINS OF GENIUS

Albert Einstein's transformation from an obscure patent clerk to the world's most famous scientist began during one 'miracle year'

BY JIM SCHNABEL

LIGHT IS BOTH PARTICLE AND WAVE. Time flows differently for objects in motion. Gravity is not a force but a warping of space. A little mass holds a fantastic amount of energy.

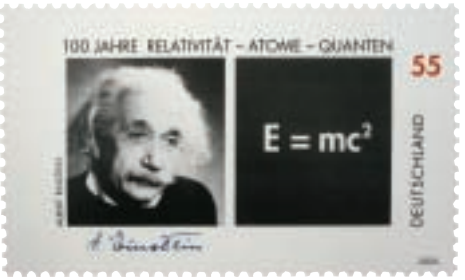
Albert Einstein's theories still boggle the mind, more than a century after he used them to ignite a scientific revolution. But who was this shaggy-haired icon of genius? Did he inherit his creativity or just have lucky breaks in life—or both?

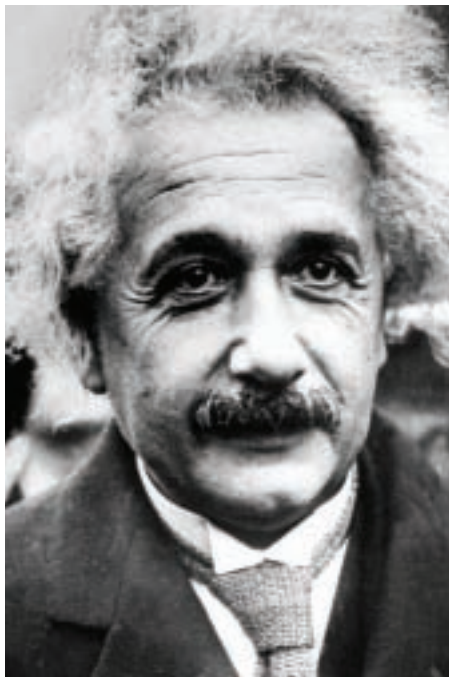
He was born on March 14, 1879, in the city of Ulm, in the Germanic kingdom of Württemberg. His family moved to Munich soon after, where his father, Hermann, and Uncle Jakob started a cutting-edge tech business, selling generators and other electrical supplies. Thus, young Albert, almost uniquely among the children of his day, had a thorough exposure to emerging concepts of electromagnetism.

Hermann, a non-practicing Jew and an opponent of the drive to unify greater Germany, also set a clear example of stubborn, non-conformity for his son—which Albert's strong-minded mother, Pauline, reinforced.

Although he did well in math and physics at Munich's Luitpold Gymnasium (essentially a high school), Einstein chafed at its traditional, rote memorization methods, and was seen as a loner and a rebel. "Your mere presence in this class destroys the other students' respect for me," complained a Greek teacher—a fellow who also blustered that Einstein would amount to nothing in life. The school later revised its view of him enough to rename itself the Albert Einstein Gymnasium. But Einstein never forgot how its methods had nearly crushed his spirit. The natural curiosity that is essential for science, he wrote decades later, is like "a delicate little plant" that "stands mainly in need of freedom."

Einstein might well have inherited a creative bent, but if so, it was not entirely a gift. He often showed a chilly detachment from people. Presented with his newborn younger sister, he asked, "Where are its wheels?" and until the age of 7 he had the strange habit of softly repeating, to himself, sentences he had just spoken. He shunned sports and crowds, preferring to read or to play the violin. Some modern psychologists think he had Asperger's syndrome, a mild autism-spectrum disorder. Einstein himself would later





admit to a "pronounced lack of need for direct contact with other human beings and human communities."

Before turning 16, when he would have been called up for military service, he renounced his citizenship and moved to Switzerland. (His parents by then had moved to northern Italy after the failure of the business in Munich.) Einstein tried to get into Zurich Polytechnic two years early, but failed the entrance exams, and instead spent two years finishing high school in the nearby town of Arau.

He was in luck, though. The school used progressive educational methods, and put unusually strong emphasis on visual conceptualization. One day there, Einstein asked himself: What would it be like to move alongside a beam of light? He later described this thought-experiment as his first step toward the theory of relativity.

He entered Zurich Polytechnic in 1896, and once again was a bit of a rebel. "I played hooky a lot, and studied the masters of physics alone," he remembered later. Einstein would graduate in 1900 near the bottom of his class. But he made friends at the school, and these included a rare female physics student, a Serbian young woman named Mileva Maric. "We understand each other's dark souls so well," he told her. Soon they were living together: two nerdy bohemians whose domestic talk was infused with advanced physics. "When I read [the physicist] Helmholtz for the first time," he once wrote to her, "I could not … believe that I was doing so without you beside me."

When Maric became pregnant in 1901, Einstein sent her to stay with her parents in Serbia, to avoid scandal. He seems to have rather coldly insisted that their first child, Lieserl, born out of wedlock, be put up for adoption. But the couple married in 1903, and had two more children. Although they separated in 1914 and eventually divorced (Einstein later married his first cousin, Elsa), Maric gave Einstein emotional and even intellectual support in those early years. She also kept house for him—which, throughout his life, he was never able to do for himself.

Einstein's poor showing at Zurich Polytechnic meant that he could not get a decent academic job. He scraped by with family money and occasional freelance teaching assignments, but his underemployment was a source of frustration.

It may have been yet another stroke of luck, though, for his isolation from academia in those years freed him to move along his own creative paths. Physics at the turn of the century—especially the classical mechanics of Isaac Newton—was rattling itself loose. Experimenters were gathering new data on phenomena such as the speed of light, and these data didn't always fit the existing theories. Einstein knew that there was a vast opportunity for a theorist who could find a way to make physics whole again.

In 1902, he finally got a steady job, at the Swiss patent office in Bern, as a junior examiner of patent applications for electrical devices. Again, he was in luck. He found that he could do his patent work in a few hours daily, leaving him plenty of time for his theorizing. His office and apartment also were not far from the train station and Bern's famous clock tower, a reference for all train-timekeeping in the vicinity. Clocks and trains were to be for Einstein what the falling apple had been for Newton.

"What would it be like to move alongside a beam of light?"

Einstein would later describe his teenage thought-experiment as his first step toward the theory of relativity.

Left to right: Einstein, pictured here at age 14, showed a chilly detachment from people throughout most of his life; the scientist enjoyed playing the violin, a pastime he began as a child; Einstein in Paris in 1929, four years before his move to the United States; an avid sailor, he loved to take his boat out on a lake, where he could relax and think; newly transplanted in America, Einstein sets the first line of type for the first enlarged edition of the *Jewish Daily Bulletin* in 1934.

Miracle Year

Einstein's transformation from an obscure patent clerk to the world's most famous scientist began in 1905. In that year he managed, despite having no academic affiliation, to get three truly revolutionary papers published in *Annalen der Physik*, one of the top physics journals of its day.

In the first, he solved a conundrum about the way in which light knocks electrons out of metal—the "photoelectric effect" by which modern solar cells work. He proposed that light interacts with electrons as it does because it is made of discrete, albeit wavelike particles (later called photons) and each of these carries a discrete level of energy, corresponding to its wave frequency.

The second big paper outlined his initial theory of relativity—later called the "special theory of relativity." Its essence was remarkably simple: New experiments showed that the speed of light (in a vacuum) was always the same in all directions and for any observer whether moving or stationary. But if the speed of light is fixed and absolute in this way, Einstein reasoned, then other properties such as time must be changeable and relative, even if the changes they undergo are usually very subtle. From a train speeding past a stationary clock tower, for example, the clock will seem to run slow. The light that carries the clock's image will take a tiny bit longer to reach the receding train, with every tick of its hands. (By the same logic, a clock on a receding train also will seem, from the platform, to run slow.)

In his final paper that year, Einstein showed that, in part due to relativity, the light-speed constant c links mass to energy: E=mc2. One implication was that nothing can travel faster than c. Another was that a little mass is equivalent to a lot of energy—a key insight that would lead to the development of nuclear power and nuclear weapons.

Celebrity

Within a few years, Einstein began to be offered academic jobs, and his career took off. Meanwhile, he developed the "general theory of relativity." Its most revolutionary concept was that gravity reflects a warping of space—and time—in the vicinity of a large mass. When astronomers confirmed during a 1919 solar eclipse that the sun's mass bent starlight to the degree that Einstein's theory predicted, he became a global celebrity virtually overnight. *The New York Times* quoted the eminent British physicist J.J. Thomson: "It is not the discovery of an outlying island, but of a whole continent of new scientific ideas of the greatest importance…"

Einstein moved his work to the U.S. in 1933, after the Nazis came to power in Germany. By the time he died in 1955—while based at a special institute at Princeton University—he had written or co-authored more than 300 papers. Even today his ideas continue to underlie large areas of physics and the technologies derived from it.

Yet the aspects of his personality that had helped him to persevere in his pre-celebrity days may have been a net liability to him in his later years. Despite being instrumental in persuading President Franklin D. Roosevelt to set up the Manhattan Project—to build an atomic bomb before Nazi Germany did—Einstein embraced an uncompromising pacifism after the war, and even publicly wished that the U.S. had never built nuclear weapons. He also somewhat obstinately resisted the emergence of quantum physics and its assertion of fundamental uncertainties, complaining that God "does not play dice"—and wasting years trying to prove that.

After Einstein died of an aortic aneurysm at the age of 76, fellow Princeton physicist Robert Oppenheimer gave a eulogy that captured, in one sentence, much of the genius' character: "There was always with him a wonderful purity at once childlike and profoundly stubborn."

The Netherlands

IN FULL BLOOM

BY SUE DE PASQUALE

Best known for its tulips and windmills, the nation is also home to rich cultural treasures

IT'S HARD TO IMAGINE A SETTING MORE BEAUTIFUL than the vast fields of North Holland in mid-April, when the region's legendary tulips are at their peak. The Bollenstreek, a 30-kilometer stretch (19 miles) between the cities of Leiden and Haarlem, blooms aglow with color—a kaleidoscope quilt of magenta, goldenrod, scarlet and deep plum—that visitors can gaze upon while hiking, driving or pedaling by on bikes.

Indeed, the Netherlands is a nation rich in natural beauty, with its fine, sandy beaches, rolling green plains dotted by windmills and picturesque villages. Compact enough to traverse with ease (it encompasses just 41,547 square miles, or 66,863 square kilometers, about one-tenth the size of California), it is a country where water plays a starring role. The French poet Voltaire once famously said, "God created the Earth—except Holland, for the Dutch did that," referring to the Dutch's centuries-long efforts to reclaim their land from the sea (through, among other methods, their famous dikes). These methods have worked: Almost half of today's provinces of North and South Holland were underwater during the Middle Ages.

Water also brought trade. While the rest of Europe struggled economically in the 17th century, merchant ships brought great prosperity to the region, making the Netherlands the financial center of the world by the mid-1600s. During this Golden Age, the city of Amsterdam became a hub for artists like Rembrandt, scientists like Van Leeuwenhoek and architects. Three great canals, bordered by magnificent houses, were built in a triple ring

The cheese market in Alkmaar; the Peace Palace in The Hague; Self-Portrait with Grey Felt Hat, 1887, at the Van Gogh Museum.

WHAT'S IN A NAME

While many people use "the Netherlands" and "Holland" interchangeably, it's worth noting that Holland comprises just two of the nation's 12 provinces (North and South Holland). Because this central western region historically dominated foreign trade (it is home to Amsterdam, Rotterdam and The Hague), it's easy to see why the Netherlands came to be called Holland overseas. But even the locals often opt for the moniker, particular in sports, where the national football team (soccer) is cheered on with the cry "Holland!"

around the city during this period, and many great buildings were erected.

Fortunately for visitors, much of this original architecture survives today—in the merchant houses of Delft, the Lakenhal in Leiden and the Mauritshuis in The Hague.

Amazing Amsterdam

Amsterdam, located just a 15-minute train ride from the Amsterdam Airport Schiphol, makes an ideal home base for your travels.

Start your visit with an overview canal tour of the city. The 100 Highlights Tour, offered through Amsterdam City Tours, slips through the old center of the city, with its merchant mansions, carillon-crowned churches and warehouses dating back to Holland's Golden Age. Keep your camera handy: Each waterway, church and merchant house you pass is more picturesque than the next. You can also use the canal boat as a way to get around the city. There are hop on/hop off canal bus packages that can be combined with discounted tickets to a host of museums.

Once you have your bearings, you might best explore Amsterdam on foot, with leisurely strolls along the canals and cafes. Don't miss the bustling Dam Square, a mecca for tourists—and pigeons. The historical city center is flanked by the neoclassical Royal Palace (City Hall from 1655 until 1808), the 15th-century Gothic Nieuwe Kerk (New Church), Madame Tussaud's Wax Museum, the NH Grand Hotel Krasnapolsky and the upscale department store De Bijenkorf.

Stay alert as you walk the narrow streets of Amsterdam. Many of the locals rely on bikes to get them around (there are many more bikes

DAY TRIPS Visit the destinations below to get a full flavor of the Netherlands:


1

2


3


4

1) Delft: Best known for its blue-and-white pottery (on sale across the city), Delft is the resting place of William of Orange (1533-84), the "father of the Netherlands" who led resistance against the Spanish in the 80 Years War. His imposing mausoleum sits inside the Nieuwe Kirk, a church with a 100-meter-high tower (328 feet) overlooking the Delft market. The De Porceleyne Fles factory, dating from 1652, is just one of several Delftware potteries that offers tours to the public.

2) Volendam: Step back in time in this old fishing village on the Ijsselmeer, just north of Amsterdam, where the locals are decked out in traditional garb: tight bodices, lace caps and striped shirts for the women; and loose jackets and trousers for the men. You can also don an outfit and have your picture taken. Built along a dike, Volendam has a bustling harbor where fishmongers hawk their catches. On the other side of the dike lies an ancient maze of narrow streets, wooden houses and canals.

3) Marken: Isolated as a fishing community for nearly 800 years, Marken became linked to the mainland with the construction of a causeway in 1957. But visitors will find a tranquil sanctuary of 17th-century wooden homes, where little has changed. Rent bikes and pedal your way around the seaside village for a relaxing afternoon. Be sure to visit the Paard Lighthouse and the Marken Museum (six historic houses), as well as the clog-making workshop and cheese factory.

4) Rotterdam: Much of Rotterdam was decimated during World War II by the German blitz, forcing the city to reinvent itself. Today it is one of Europe's most vibrant and multicultural cities, featuring cutting-edge architecture and a lively cultural life. Most importantly, Rotterdam boasts the largest port in the world. Home to the *Rotterdam V*, a floating museum/hotel, the port also serves as the launching point for Holland America Line cruises bound for Northern Europe and the Mediterranean.

The Provinces of The Netherlands

Clockwise: Science museum NEMO; bikes at Central Station in Amsterdam; a canal in Amsterdam.

than people in the city) and they zip to and fro at great speed, seemingly from both directions. Likewise, it's not unusual for cars to drive in the bike lanes or even park up on the sidewalks.

With the city's rich cultural heritage, museums abound. Art lovers will want to devote at least a day or two to the Museum Quarter, one of the wealthiest districts in Amsterdam, which features a stately green park ringed by major cultural centers. Among them: the Rijksmuseum, a Neo-Gothic wonder that offers the best collection of Dutch art in the world; the Van Gogh Museum, featuring exhibits of 19th-century art; the Stedelijk Museum, the national museum of modern art, with works by Picasso, Matisse and Monet, among many others; and the Concertgebouw, Amsterdam's premier concert hall.

There are many more attractions outside the district, too many to list here, but a few bear noting. The Anne Frank House, where the Jewish Frank family hid from the Nazis during World War II and young Anne penned her now-famous diary, draws nearly 1 million visitors each year. Lines are long, so it's best to purchase tickets online in advance for the 45-minute tour. Parents traveling with children can balance this somber experience with a trip to NEMO, the Netherlands' largest science museum, which is built in the shape of a gigantic ship and offers plenty of hands-on fun and learning. A short walk from there is the Artis Royal Zoo, constructed in 1838; the historical zoo/park features a butterfly pavilion, planetarium and a bird house, as well as animals of every stripe—from wildebeests to zebras.

Art lovers will want to devote at least a day or two to the Museum Quarter, one of the wealthiest districts in Amsterdam, which features a stately green park ringed by major cultural centers.

While Amsterdam is family friendly, it is also known for its decidedly "adult" side, exemplified in the bawdy Red Light District, which dates back to the 14th century when sailors arrived looking for female company. Today this area, with its garish sex shops and seedy clubs, is relatively tame by day. By night, it's best not to wander off the main streets, for safety's sake. Smoking marijuana is legal in parts of Amsterdam, and smoke-filled "coffee houses" are not confined just to the Red Light District. But the district is

home to the Museum of Hash, Marijuana, and Hemp, which includes a small room where hemp plants are grown under artificial light.

Beer lovers will feel right at home in Amsterdam, where the numerous cafes are well stocked with Belgian brews and local favorites like Heineken. To learn more about that beer's origins, visit the Heineken Experience—a tour that culminates in a couple of crowded bars where you can partake of two nice-sized samples of the amber brew.

Foodies will be pleased to find a wide variety of gastronomic offerings in the restaurants and cafes of Amsterdam and beyond. Be sure to sample a tosti or two—variations on grilled cheese and ham that vary by establishment—and a *broodje kroket* (croquette), as well as some *drop* (licorice) that comes both sweet *(zoete)* and salty *(zout)*, or a piping hot box of *vlaams frites huis* (fries with Belgian mayonnaise). And, of course, the city is dotted with cheese shops, which offer shelves of giant waxed rounds of Edam, Gouda and other locally made cheeses.

For those less than enthusiastic about meat-and-potatoes Dutch fare (and herring!), take heart: Amsterdam embraces global cuisine with a vengeance. Restaurants offer Thai, Ethiopian, South African, Moroccan, Italian, Greek and Indian food, with the most popular foreign cuisine being spicy Indonesian. For dinner, it's best to make reservations in advance: Restaurants fill up quickly and once gregarious Amsterdamers sit down, they are usually there for the evening.

One last tip … on tips: Restaurant and hotel staff in the Netherlands do not expect the 18 to 20 percent gratuity that is customary in the United States. Feel free to tip for good service if you'd like, but you won't be considered a cad if you leave 5 or 10 percent—or nothing at all.

THE ESSENTIALS

Currency:The Netherland uses the euro, though some souvenir shops accept U.S. dollars. The best place to change money is at a bank ATM.

Language: English is widely and fluently spoken, particularly in the major cities. But learning a few Dutch phrases ("Dag" for "Good Day") will earn you points with the locals.

Climate: Cool summers (20C, or 68F) and mild winters (temperatures rarely dip below 0C or 32F) characterize the region. Pack a raincoat and umbrella; showers are frequent, especially in summer.

Getting Around: For traveling between major cities, trains are a great bet; they run frequently and on time. For inter-city travel, use the well-established public transportation system (buses, light rail), or rent bikes.

Accommodations: The Netherlands offers a wide range of places to stay, from bed-and-breakfasts to hotels (budget to luxury) to old castles and historical buildings that have been converted to lodgings.

A statue of Simon de Montfort on the Haymarket Memorial Clock Tower in Leicester, England.

THE FOUNDING OF

PARLIAMENT

How one earl's radical idea became the precedent for elected government BY EUGENE FINERMAN

IN 1215, REBELLING AGAINST the repressive rule of King John, the barons of England forced the cowed monarch to sign the Magna Carta, a charter of concessions defining and restricting his power. Henceforth, the king could no longer arbitrarily arrest an Englishman or seize his property. Neither John nor any other English king would again be a tyrant.

However, the Magna Carta did not guarantee the king's competence. The monarch was still free to be weak, inept and reckless; and Henry III—the son of John—fully exercised those dubious prerogatives. In 1264, the barons rebelled again, now to impose some restraining responsibilities on the bankrupt crown. And the rebels' leader Simon de Montfort had a remarkable idea about how to accomplish that: a governing council with elected representatives.

Ironically, the pioneer of parliamentary government had nothing liberal in his pedigree or upbringing. Simon de Montfort was an aristocrat, the son of a warlord who had made a fortune in the Crusades. Nor was Simon even English, but French. France, however, afforded him few opportunities; his older brother would inherit the family estates. But he did have a tenuous claim to an English title: The last Earl of Leicester had died childless, and Simon was his great-nephew. So in 1230 the 22-year-old Frenchman traveled to England to become an earl.

Thirteenth-century England was a feudal society. The king and 200 nobles ruled 4 million people. There were some 80 boroughs, their term for cities and towns. London was the largest—with a population of approximately 30,000. Most of the English—at least 80 percent—were peasants, and half of those peasants were serfs, considered little more than human livestock. The ruling class and their subjects barely spoke the same language. The French spoken by the aristocracy and the Angle-Saxon spoken by the commoners was gradually evolving into a mutually understood language: Middle English. And on the English throne was the affable catastrophe Henry III.

De Montfort was not the only fortune hunter at the English court, and most of them were French like him. The king had many Gallic relatives and they all made themselves his guests. But Simon, with his soldier's bearing, stood apart from the fawning courtiers. Henry was impressed and so granted Simon part of the Leicester inheritance. De Montfort could have the lands and income of the earldom but not the actual title. That would have to be earned. The king expected mili-

In 1215, King John (left) was forced to sign the Magna Carta, restricting the power of the monarch. While still a prince, King Edward I (right) led the military effort that defeated Simon de Montfort.

tary service, but Simon chose a different type of campaign. Eleanor Plantagenet was an attractive young woman; she was also the king's sister. Simon married her, and Henry's wedding present was the earldom.

In his rise to prominence and power, the Earl of Leicester earned both the envy and the enmity of other courtiers. The king could be easily swayed by malicious reports, and so Simon often found himself the victim of the royal whimsy. Although he had certainly proved himself adept at court politics, Simon loathed it. He fled the sordid intrigues by going on a crusade in 1240. He returned to England and the politics a year later, but he would always speak longingly of the Crusades and their moral clarity.

When the king summoned the Royal Council, an assembly of England's leading nobles and clergy, it was sometimes for their advice but usually for their money. The Magna Carta forbid the king from raising taxes without the council's consent. Of course, the Earl of Leicester was a member of the Royal Council. He had first been a staunch supporter of the king; that might be expected of a rising courtier and a brother-in-law. Over time, however, experience and disillusionment turned him into a critic.

Henry's rule was an appalling farce.

When the king summoned the Royal Council, an assembly of England's leading nobles and clergy, it was sometimes for their advice but usually for their money.

Royal offices were doled out to corrupt, incompetent favorites. Wars were lost through cowardice and mismanagement. The king bankrupted the treasury pursuing ridiculous schemes; one was a campaign to win the crown of Sicily. And, in 1258, when the king wanted more money for this Sicilian fiasco, the council not only refused but, led by de Montfort, demanded constraints upon Henry and the reform of the government.

The outraged nobles could not be ignored. Each one had a personal army and their combined might could overwhelm the king's forces. Intimidated, Henry agreed to abide by whatever reforms would be determined by a special session of the Royal Council. Representatives of the king and the barons met at Oxford to create a program of reforms. They intended to limit the king's power and to impose on government officials a standard of ethics and competence. Their proposals are now remembered as the "Provisions of Oxford."

According to the provisions, the king would be under the supervision of a 15-member governing council called a "parliament." "There are to be three parliaments a year. … To these three parliaments the chosen counselors of the King shall come, even if they are not summoned, in order to examine the state of the kingdom and to consider the common needs of the kingdom and likewise of the King." Note that the parliament would meet regardless of Henry's approval. The provisions also imposed term limits of one year on all royal appointees, and these appointees would have to report to the parliament.

Henry agreed to the provisions in October 1258, and then spent the next two years stalling on their implementation. All the while, Henry was corresponding with the pope, pleading for the church to absolve him from his pledge. In April 1261, the pope did, and now Henry could sanctimoniously reject the reforms.

However, the church had not threatened to excommunicate de Montfort and the barons; so they could still demand the provisions. With England on the verge of civil war, Henry offered another proposal. King Louis IX of France was renowned for his sense of justice; why not let him arbitrate the dispute? De Montfort agreed, however, Louis was still very much a king, and he was not going to undermine the principles of monarchy. In January 1264, he decided in Henry's favor.

The nobles had no alternative but war; and they had no better leader than Simon de Montfort. He was 56 years old, an old man in those times, but still eager to lead this crusade. King Henry and his son Edward were gathering their forces at Lewes, in Southeastern England. De Montfort had a smaller army but he knew Henry's incompetence and Edward's inexperience. The earl attacked; by the end of the day, Henry and Edward were prisoners and Simon de Montfort was "the uncrowned king of England." Henry would remain king, if only in name. The actual power would be in the hands of a triumvirate of regents: de Montfort, of course, and his allies the Bishop of Chicester and the Earl of Gloucester.

Timeline

1215: The barons of England force King John to sign the Magna Carta

▼

1230: Simon de Montfort travels to England to become an earl, under King Henry

▼

1258: de Montfort leads reform of the corrupt rule of King Henry; The king agrees to form an elected "parliament" but stalls on implementation

▼

1261: The pope absolves Henry from his pledge and he rejects the reforms

▼

1264: King Louis IX of France arbitrates the dispute and decides in Henry's favor

▼

1264: de Montfort launches an attack; becomes "the uncrowned king of England" after taking Henry and son Edward prisoner

▼

1265: De Montfort convenes a parliament, calling for elected representatives from 37 counties and 80 towns of England

▼

August 1265: Edward escapes and leads victorious effort to kill De Montfort

▼

1275: Now King, Edward I realizes that support of the commoners is important; He summons a parliament

But de Montfort knew that there had to be a sound and lasting basis for responsible government. Both the provisions' proposed parliament and the Royal Council had been an assembly of aristocrats. De Montfort wanted a parliament that drew upon the advice and consent of the commoners. So, he would convene a parliament in January 1265, and he ordered the 37 counties and some 80 towns of England to send elected representatives. It was unprecedented, and many of de Montfort's fellow barons were appalled. Some, including the Earl of Gloucester, would now conspire to restore the king. What happened at de Montfort's parliament? Ironically, we do not know the details of this momentous event. No records have survived.

Those enemies were gathering strength. With the help of the treacherous Gloucester, Prince Edward had escaped and now was rallying an army in the west of England. De Montfort led an army in pursuit, bringing along Henry as a hostage. The earl camped at Evesham and awaited reinforcements. They never came. Prince Edward, proving himself a bold and capable commander, had destroyed that force and now would surprise de Montfort. The earl was killed, and his body mutilated, its parts sent throughout the kingdom as trophies. King Henry was released from one captivity but placed in another. The real ruler would be Prince Edward. Ironically, Edward was exactly what the defeated barons had wanted in a king: strong, efficient and responsible.

He would also prove a statesman. When King Edward I summoned a parliament in 1275, he ordered the counties and towns of England to send elected representatives. A wise king would want the support and the advice of the commoners. So de Montfort's radical idea became the precedent of parliament, and the basis of representative government. Today, a descendant of Edward sits on the British throne, but the heirs of Simon de Montfort—the elected members of Parliament—rule Britain.

A Bad Fit

'Saving money' by altering fittings can be costly

> The hose shop's new hire quickly realized that if there were a dirty, disgusting job to be done, it would land in his lap. One day, a customer's truck pulled up and the shop leader went over to it to see what was up. After a short conversation with the chemical plant driver, the shop leader motioned for the newbie. The shop leader explained that the customer's hose had only been in service for a week and had gotten run over by a tanker truck. The hose was shot and it needed to be replaced, but the fittings were basically new and the company had paid good money for them. He then told the new guy to cut the fittings out of the hose, get the same hose from stock, and put the customer's fittings in the new hose. Using some colorful language, the shop leader instructed the newbie to do it quickly, since the driver was going to wait.

Cutting fittings out of a hose was something the new guy had never done before so he asked his boss how to go about it. His boss replied, "Take that air grinder, cut the bands off, then cut up and down the hose where the fitting is until it starts to open up and pull the fitting out." After the band clamps were cut off, the newbie quickly understood why he was selected for the job. As soon as the air grinder touched the hose, smoke and dirt went everywhere. The smoke got so bad after a while that he couldn't see where he was cutting. He kept going up and down the hose like he was told, and occasionally sparks would fly along with the smoke and dirt. After a few minutes (which seemed like an hour), the hose opened up and the fitting fell to the floor. He picked up the fitting and noticed grinding marks on the shank that were particularly deep and sharp on the end. He went to ask his boss about this, but before he could say anything he was told in no uncertain terms to finish the job—now.

A few days later, the distributor received a call from the chemical plant telling them their new hose started leaking through the cover near one of the fittings; the leak sent thousands of dollars' worth of chemicals down a storm drain. Because of the type of chemical, the leak could lead to many thousands of dollars in EPA fines. The distributor also was informed that the cause of the spill was that the fitting had cut through the plastic tube in the hose.

Before reusing any industrial hose coupling, consult the manufacturer. Ask if it can be reused and, if so, what the inspection procedures are. Fittings in chemical service pose additional dangers. First, there could be some residual chemical trapped between the hose and the coupling, and the heat from the grinding wheel could produce noxious fumes or catch fire. Second, the shank could look perfectly fine, but be eroded past a safe wall thickness. Permanent fittings should not be reused because the shank can deflect from the pressure of swaging or crimping. If reused and deflection has occurred, fitting dimensions, which are proprietary, are altered. This negatively affects the swage/crimp parameters and can reduce the coupling's holding power.

Removing any fitting from a hose must be done with extreme care. Even the slightest mark on the shank alters it from its original design and is reason to discard it. Product alteration is not condoned by any manufacturer and voids all warranties. Once you alter a product you "own" it and are responsible for any and all consequences. The few dollars saved today could cost you many thousands tomorrow.

Alteration: Dixon does not recommend the altering of any of our clamps, fittings or other products by anyone in the field. The Dixon product line is engineered to precise tolerances and intended for specific services. Altering a finished product can cause changes in the metal or other properties resulting in safety concerns for the user. If you have a special application not covered by our standard product line, please contact Dixon or your Dixon distributor for advice.

Fitting Inspection: An ongoing program of inspection of fittings, clamps and/or ferrules must be instituted to maintain safe and operable assemblies. The inspection should include the body, all threads, seals and clamps (ferrules). If gaskets are damaged or missing, they must be replaced immediately. Damaged fittings, clamps or ferrules must be removed and replaced immediately.

THE DIXON DRILLER

"Published once a moon since 1932"

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TRIVIA Did you know that...

Vanilla flavoring is derived from orchids.

The term used for the science of growing an apple is Pomology.

Amen in Hebrew means "so be it."

1 knot of speed is equivalent to 1 nautical mile per hour.

A bull's-eye is worth 50 points in the game of darts.

Monaco is the world's most densely populated country.

Pinocchio, in Italian, means pine head.

A barometer measures atmospheric pressure.

At the start of a chess game each player begins with eight pawns.

Greenland is the world's largest island.

An Olympic size swimming pool has eight lanes.

In 1952, Israel offered Albert Einstein its presidency.

The southern most capital city in the world is Wellington, New Zealand.

The first U.S. billionaire was John D. Rockefeller.

The diameter of a golf hole is four inches.

You have $1,500 at the start of the game Monopoly.

The Latin word circa before a date means "about."

The elephant is the only animal with four knees.

The second largest country in the world is Canada.

www.randomtriviagenerator.com

ON THE LIGHTER SIDE

A lady went to a psychiatrist complaining of a terrible phobia. "Every time I lay down on my bed I get this terrible fear that there is something underneath." "Wow," responded the psychiatrist, "I've never heard of such a phobia, but like all phobias it can be treated, but it will likely take around 20 sessions." "OK," responded the lady. "How much is each session?" "Oh it's just $80 a session, but trust me it's well worth it." When the lady didn't come back to the psychiatrist he gave the lady a call. "How come I didn't hear from you?" he asked. "Well," responded the lady, "when I came home and told my husband about the cost he thought he would save some money. He just cut the legs off the bed!"

Three engineers and three accountants are traveling by train to a conference. At the station, the three accountants each buy tickets and watch as the three engineers buy only a single ticket."How are three people going to travel on only one ticket?" asks an accountant. "Watch and you'll see," answers an engineer. All of them board the train. The accountants take their respective seats but all three engineers cram into a restroom and close the door behind them. Shortly after the train has departed, the conductor comes around collecting tickets. He knocks on the restroom door and says, "Ticket, please." The door opens just a crack and a single arm emerges with a ticket in hand. The conductor takes it and moves on. The accountants saw this and agreed it was a clever idea. So after the conference, the accountants decide to copy the engineers on the return trip and save some money. When they get to the station they buy a single ticket for the return trip. To their astonishment, the engineers don't buy a ticket at all. "How are you going to travel without a ticket?" says one perplexed accountant. "Watch and you'll see," answers an engineer. When they board the train the three accountants cram into a restroom and the three engineers cram into another one nearby. The train departs. Shortly afterward, one of the engineers leaves his restroom and walks over to the restroom where the accountants are hiding. He knocks on the door and says, "Ticket, please."

www.greatcleanjokes.com

PRODUCT SPOTLIGHT

Dixon Fire

Since 2006, Dixon Fire has steadily built the trust of its customer base through the manufacture and distribution of quality UL and FM approved brass fire products.

In June of 2011, Dixon acquired Northline Coupling Systems, based in Mississauga, Ontario. This acquisition further expanded its product offering to include aluminum fire products, valve hardware, Storz connections and dry hydrant systems.

The entire span of Dixon Fire's product offering, including both the Powhatan and Northline brands, are available through Dixon's 12 warehouses around the United States, three in Canada and one in Mexico. This broad product mix is also illustrated in the 2012 Dixon Fire catalog or through the website dixonfire.com.

To order a 2012 catalog, or for additional information, call customer service in the U.S. at 877-712-6179, or 800-786-9697 in Canada, or visit dixonfire.com.

Dates in History

March 1, 1932
Lindbergh baby kidnapped

On March 1, Charles Lindbergh III, the 20-month-old son of aviation hero Charles Lindbergh, was kidnapped from the family's new mansion in Hopewell, N. J.

March 1, 1966
Soviet probe crashes into Venus

On March 1st, Venera 3, a Soviet probe launched from Kazakhstan on Nov. 15, 1965, collided with Venus, the second planet from the sun. Although Venera 3 failed in its mission to measure the Venusian atmosphere, it was the first unmanned spacecraft to reach the surface of another planet.

March 1, 1961
Kennedy establishes Peace Corps

On March 1st, John F. Kennedy issued an executive order establishing the Peace Corps. This force would be made up of civilians who would volunteer their time and skills to travel to underdeveloped nations to assist them in any way they could. During the 1960s and 1970s, thousands of Americans—especially young people—flocked to serve in dozens of nations, particularly in Latin America, Africa, Asia and the Middle East. The program continues to function, and thousands of Americans each year are drawn to the humanitarian mission and sense of adventure that characterizes the Peace Corps.

March 5, 1963
Hula-Hoop patented

On March 5th, the Hula-Hoop, a hip-swiveling toy that became a huge fad across America when it was first marketed by Wham-O in 1958, is patented by the company's co-founder, Arthur "Spud" Melin. An estimated 25 million Hula-Hoops were sold in its first four months of production alone.

March 6, 1899
Bayer patents aspirin

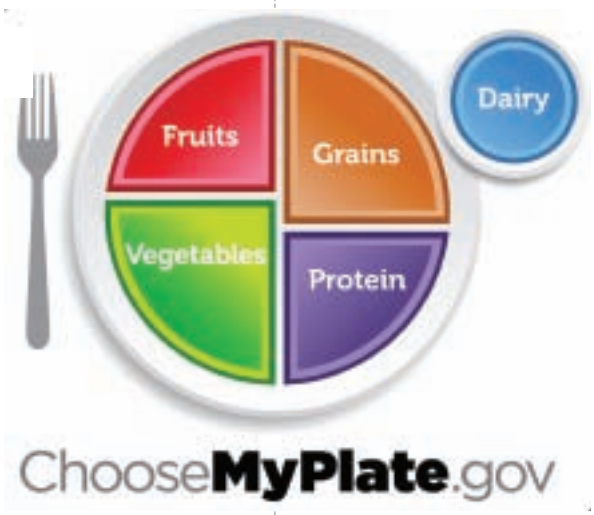
On March 6th, the Imperial Patent Office in Berlin registered Aspirin, the brand name for acetylsalicylic acid, on behalf of the German pharmaceutical company Friedrich Bayer & Co.

www.history.com

BY MARY K. ZAJAC

Dishing It Up

Look to 'the plate' to guide healthier eating



> There's a new food icon in town, and it doesn't wear a chef's hat or participate in high-profile television cooking competitions.

Enter the food plate, the U.S. Department of Agriculture's new symbol of healthy eating that replaces the old food pyramid. The new graphic is a familiar one: a dinner plate. It is divided into four nearly equal portions of fruit, vegetables, grains and proteins, with a serving of dairy on the side. The USDA's website, *www.choosemyplate.gov*, offers sample menus and encourages Americans to reduce portion size, add a variety of foods to their daily diet and cut back on consumption of sugary drinks while upping water intake.

Dietitians such as Bethany Thayer, American Dietetic Association spokeswoman, praise the plate graphic for its "simpler, visual approach." The pyramid, says Thayer, gave "too much information" and was "too abstract and overwhelming."

By contrast, she says, "everyone knows [and recognizes] what a plate is."

Below, three registered dietitians offer tips on how adults can use the plate to guide their way to healthier eating.

Three meals a day make all the difference

The plate model emphasizes three meals a day because "skipping meals can be just as bad as overeating," says Jim White, ADA spokesman. When you miss breakfast or lunch, you tend to overcompensate or make bad decisions on the next meal because you're starving. During the workday, unhealthy eating habits also can lead to lack of energy and confidence, not to mention stress.

THE PLATE MODEL EMPHASIZES THREE MEALS A DAY BECAUSE "SKIPPING MEALS CAN BE JUST AS BAD AS OVEREATING," SAYS JIM WHITE.

Breakfast is the most important meal of the day, says White, and missing it is gambling with obesity. White suggests easy breakfasts like a whole grain English muffin with peanut butter, whole grain cereal with skim milk or a cup of yogurt plus a piece of fruit as a good way to start the day.

Healthy lunch options include chicken burritos with rice or beans (skip the cheese and sour cream but not the avocado), sandwiches on whole grain bread paired with soups and salads and veggie-heavy stir fries, according to dietitian Manuel Villacorta, founder and creator of *Eating Free*.

Size matters

Portion size also is crucial, reminds Villacorta. You may be eating all the right things, but eating too much of even healthy food can result in "growing your waistline organically," he says tactfully.

Half of your plate at each meal should be vegetables and fruit. The remaining half should be one-quarter grain and one-quarter protein. But how

much is a quarter?

When it comes to protein, says Villacorta, "talk to the hand." Whether it be pork, chicken, lean meat or fish, your protein should be "the size of your palm." For men, this means 5 or 6 ounces (for women, it's more like 3 ounces, the size of a deck of cards).

Keep this in mind in restaurants, which often serve larger portions of meat and potatoes with little emphasis on vegetables. Prepare for a restaurant meal by cutting back on portion size during the day. Plan to take home restaurant leftovers and consider ordering a side vegetable or salad to round out your meal, suggests Villacorta.

Variety is the spice of life

A colorful plate is a healthy plate, contends Villacorta, so when you're choosing vegetables, the more variety the better. "Different colors give you different health benefits," says Villacorta. "Don't just do green. Don't just do red. Add at least two or three colors."

Remember, too, to balance starchy vegetables like potatoes and corn with leafy greens such as salads or spinach or cruciferous vegetables like broccoli and cauliflower.

Make it easy on yourself

Everyone has something they dislike eating, says White. The trick is to "find foods you do like and stick to them." Say you're not a fruit eater. White suggests seeking out pure juices made from concentrated fruit or mixing a fruit you do like into a smoothie with yogurt and peanut butter. If adding a little low-fat whipped cream is going to make those blueberries more palatable, White says do it.

Salads are also an easy way to load up on items that might be lacking in your diet. "Make your salad fun by adding fruit, like oranges or dried cranberries, or nuts or cheese," advises Rebecca Denison, doctor of integrative medicine, and diabetes educator at Greater Baltimore Medical Center in Maryland.

And don't overlook grocery store conveniences. It can be a lot easier to build a salad or snack healthily if you buy already cut-up pineapple or "baby" varieties of vegetables like carrots and grape tomatoes.

Give yourself a day off

Face it. Even though we want to eat healthy, we also want to indulge every now and then. White says choosing one day a week to enjoy dark chocolate or a glass of red wine is a good thing. "If you can be moderate, say 100 to 150 calories, indulging once a week can help your psyche," explains White. "As long as it's not in excess, don't feel guilty."

Soft Landings

The advent of the parachute makes it possible to take the plunge safely

> Sixteenth-century painter Leonardo da Vinci is best known for his artistic masterpieces, which still have the power to take our breath away. But many historians also credit him with the first real concept for the modern day parachute. Da Vinci sketched the device in his *Codex Atlanticus* in 1485; it consisted of a canopy of cloth stretched over a wooden frame that was roughly the shape of an inverted ice cream cone.

That design was just an idea, though, until 1617, when Croatian scholar Faust Vrancic elaborated on it (he changed the frame to a rectangle) and leapt from a Venetian tower wearing it. He must have survived the plunge, because drawings of his "Homo Volans" (Flying Man) appeared 30 years later in a book by John Wilkins.

DA VINCI'S SKETCH CONSISTED OF A CANOPY OF CLOTH STRETCHED OVER A WOODEN FRAME THAT WAS ROUGHLY THE SHAPE OF AN INVERTED ICE CREAM CONE.

But credit for the first really practical, modern parachute often goes to French physicist and inventor Louis-Sebastien Lenormand. In 1783, he became the first person to make a witnessed public descent via parachute when he jumped from a tower of the Montepellier Observatory while he was affixed to a 14-foot wooden-framed parachute.

Around that time, fellow Frenchman and balloonist Jean-Pierre Blanchard came up with the term "parachute," combining "para" (against) and "chute" (fall). In these early days, parachutes were mainly seen in circus acts, with trapeze artists using them to perform stunts. Public opinion of the device was understandably negative after 61-year-old amateur scientist Robert Cocking plunged 5,000 feet to his death—despite being attached to a cone-shaped parachute—in front of a crowd during Grand Day Fete in 1837 at London's Vauxhall Gardens.

Nonetheless, some intrepid individuals continued to work on the invention's design, with the addition of a harness and a "breakaway" component (in which one parachute inflates, is released and pulls open a second) taking place in the late 1890s. An 85-pound California teen—Georgia "Tiny" Broadwick—made the first free fall parachute jump in 1908 and technology improved rapidly after that, with a parachute testing and training center established by the military at Wright Field in Dayton, Ohio, in 1918.

From World War I to the 1930s, round silk chutes were used by the military in the United States, Europe and Russia. During World War II, Germany's Luftwaffe corps showed the world just how effectively the devices worked to strategically move troops to battle sites. Improvements in design and materials to make the chutes lighter, stronger and safer continued in the decades after the war.

Today, most parachutes used by skydivers are self-inflating "ram-air" airfoils—known as "parafoils." These have two layers of fabric that are connected by "cells" of airfoil-shaped fabric ribs. For safety's sake, contemporary parachutes are designed to open softly, thanks to a "slider," a piece of fabric that slows the spread of the parachute's rigging lines.

Despite ongoing advances, the world record for the highest parachute jump dates to Aug. 16, 1960, and the U.S. Air Force's Excelsior Project (experiments aimed at ensuring that jet pilots could descend safely after high-altitude ejection). Pilot Joe Kittinger stepped from a hot-air balloon at 31,333 meters (102,800 feet) and into a free fall that lasted an amazing 4 minutes, 36 seconds—with speeds reaching 988 kilometers per hour (614 mph) and temperatures as low as −94 F (−70 C). Finally, at an altitude of 5,330 m (17,500 feet), Kittinger deployed his main parachute and landed safely in the New Mexico desert. The total time of the descent: 13 minutes, 45 seconds.

Aptly, a plaque was afterward attached to the open door of the Excelsior gondola, with the words, "This is the highest step in the world."

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